Contents

1.0 Purpose/Scope 1
2.0 Responsibilities 2
3.0 Definitions 2
4.0 Prerequisites 3
5.0 Precautions 4
6.0 Procedure 6
7.0 References 9
8.0 Attachments 10
8.1 Theory of Sampling 12
8.2 Photograph of meter 13
8.3 Short Operating Instructions 14
8.4 XRF Survey Form .....
9.0 Documentation 10

1. Purpose/Scope

This document describes a field procedure for usage of the NITON X-Ray Fluorescence (XRF) XL300 detector (blue colored cover) to conduct non-destructive testing of potential lead-based paint surfaces. It is based on methodology described in the Department of Housing and Urban Development (HUD) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* 1990, revised 1995 and the manufacturers recommendations.

OSHA regulations pertain to worker exposure and are not limited to lead content of materials. They are currently working on a study of XRF testing and this SOP will be updated once the study is completed and published.

The goal of this SOP is to provide a uniform methodology to determine the presence of lead in surface coatings and the concentration of lead detected. Using this method will ensure repeatability between various sampling personnel, substrates and surface configurations.

This field procedure describes elements necessary for sampling using best management practices described by organizations that have developed procedures based on lessons learned experience. This procedure should be viewed as a best management practice.

2.0 **Responsibilities**

2.1 This program is implemented through the SHSD Industrial Hygiene Group. The IH Group Leader may assign the duties to a *Program Administrator*. Members of the SHSD Industrial Hygiene Group, the Radiation Control Division Facility Support Group, and Plant Engineering can qualify to perform tasks in this program based on their approval by the Industrial Hygiene Group Leader or Program Administrator.

2.2 Personnel who have demonstrated competency in performing tasks, in accordance with the Policy Section of this procedure, will be qualified to serve as Qualified Sampler by the Group Leader or Program Administrator, or their designee.

2.3 Data Quality Control procedures: The qualified sampler is responsible for the integrity of the data until properly transferred to the IH Group laboratory using the SHSD established procedures. To have the data included in the SHSD IH group databases, approval of the data by the IH Group Leader or designee is required. Approval will be contingent on documentation that appropriate sampling procedures were followed including calibration checks before, during and after the work, submittal of an appropriate data form and any other requested documentation to the IH group.

2.4 Hazard Analysis of the Sampling Task: It is the responsibility of the Qualified Sampler and their supervisor to ensure that training is current and the appropriate personal protective equipment is worn. In addition, the person performing this procedure and his/her supervisor are responsible to ensure that all required training and qualification for hazards that may be present in areas where this procedure will be used (such as respiratory protection or radiation contamination) have been met. The Qualified Sampler and their line supervisor are responsible to comply with all work planning and work permit system requirements.

2.5 Emergency Procedures: It is the responsibility of the Qualified Sampler to know and understand the emergency procedures in case of an accident or loss of the equipment.

2.6 Log In/Out: The Qualified Sampler will complete the sign in/out log in the IH equipment room prior to and after each daily use. The instrument is to be returned to the IH equipment room at the end of each days use.

3.0 Definitions

3.1 ***Program Administrator:*** A person designated by the IH Group Leader or SHSD management to administer this procedure and the associated program of XRF data management.

3.2 ***Qualified Sampler:*** A person who has demonstrated competency, in accordance with Section 6, to perform this field procedure and is approved to independently use the Niton XL-300 and interpret results.

3.3 ***Lead-Based Paint:*** Any paint, varnish, shellac, or other coating that contains lead equal to or in excess of 1.0 mg/cm^2 as measured by an x-ray fluorescence analyzer or laboratory analysis or 0.5% by weight by laboratory analysis.

3.4 ***XRF Performance Characteristic Sheet:*** Manufacturer's technical data sheet providing information on the instrument use characteristics including: positive, negative and inconclusive ranges of the detector and substrate corrections if any are necessary.

4.0 Prerequisites

4.1 **Training**:

- 4.1.1 RadWorker 1 (HP-RWT002) or RCT Qualified
- 4.1.2 Training - Lead In The Workplace awareness training TQ-LEAD 1
- 4.1.3 Review of the Lead Subject Area

4.2 The SHSD Industrial Hygiene Group Leader, Program Administrator, or their designee will qualify personnel in the use of, and interpretation of results for, the Niton XL-300 Lead Analyzer.

4.3 **Qualification Criteria:** The qualification criteria to perform this procedure are:

- 4.3.1 Manufacturers training provided by either a qualified manufacturer's representative or the IH Group Leader, Program Administrator or their designee who has received the Manufacturer's training and been approved by the IH Group Leader or Program Administrator to provide this training to other approved individuals.
- 4.3.2 Knowledge of industrial hygiene practice (awareness level).
- 4.3.3 Specific knowledge of this procedure.
- 4.3.4 Demonstrated competency in performing this test to the satisfaction of the IH Group Leader or Program Administrator via:
  - 4.3.4.1 Visual observation of proper detector usage technique.

4.3.4.2 Ability to answer questions on the sampling procedures, custody of the instrument and emergency procedures during sampling and transportation.

4.3.4.3 Knowledge of the appropriate personal protective equipment for the hazards of this particular type of sampling.

4.3.4.4 Knowledge of the appropriate personal dosimetry required for documentation of exposures.

4.3.5 **Qualification Frequency & Recordkeeping:** The SHSD IH Group Leader, Program Administrator, or their designee will maintain a record of personnel who have passed the competency test and make the information available to other IH Program Administrators and Facility Support supervisors.

4.3.5.1 Personnel shall be re-qualified at a frequency not to exceed three years, provided there is no break in the work assignment that utilizes this procedure.

4.3.5.2 If a person has not performed instrument usage for a period of over 6 months from the date of last qualification, demonstration of competency to perform this procedure to the satisfaction of the Program Administrator, the IH Group Leader or a designee of the Program Administrator will be required before sampling commences.

4.3.5.3 If significant and substantive changes to the procedure are made, Qualified Samplers will be notified of the changes.

4.3.6 **Meter Use Tracking:** A sign in/out log is required for distribution of the instrument and will be completed prior to and upon return of the instrument. Required information includes the users name, location(s) the instrument will be used, and a phone or pager number allowing contact of the user while the instrument is in their possession.

5.0 Precautions

5.1 **Hazard Assessment:** For all work done under this SOP there shall be a hazard assessment to determine the inherent hazardous conditions, evaluate the degree of hazard to individuals and put in place appropriate protective measures based on the hierarchy of controls.

5.2 **Work Planning:** All requirements of work permits and work planning system reviews must be met in performing this procedure.

5.3 **Waste Disposal/Pollution Prevention:** Prior to project initiation, all waste generation anticipated will be evaluated to determine if product substitution, process changes or other recommended alternative actions can be utilized to eliminate/minimize waste generation and/or environmental degradation.

5.4 **Personal Protective Equipment:** Appropriate personal protective equipment to protect the person collecting the sample must be used when implementing this procedure. Each area entered for testing must be evaluated for required personal protective equipment. Other PPE, as well as environmental protection materials, must be available in the event bulk sampling of paint films becomes necessary. **Personal Protective Equipment that may be needed are:**

- 5.4.1 Appropriate respirator and filter cartridges for bulk sampling lead based coatings.
- 5.4.2 Gloves (latex, Nitrile, or PVC disposable or reusable style).
- 5.4.3 Protective clothing for protection from lead dust (Tyvek®, Kleenguard® or equivalent.
- 5.4.4 Gloves and protective clothing for protection from radiation of dust/paint chips when dealing with radiation contaminated surfaces.

5.5 **Radiation Contamination:**

- 5.5.1 It is possible that some surfaces to be tested may have radiation contamination. In these cases, personal protective equipment and administrative controls must be implemented for the radiation contaminant hazard of the surface as well as the instrument. In addition, bulk samples must be analyzed for radiation hazard before they can be submitted to the IH Group for analysis whether they are collected to verify XRF readings, determine results of inconclusive readings, or because the material is not testable based on size, shape, etc. At no time will the IH Group accept a bulk sample with radiation contamination above permissible limits for the general public.
- 5.5.2 The meter contains a regulated radiation source and must be transported only within the original manufacturer supplied instrument case. The qualified sampler must maintain possession with the meter at all times or store the meter in a limited access controlled area (such as a locked vehicle or locked room or locked cabinet).

6.0 Procedure

6.1 Equipment

6.1.1 XRF Survey Meter

6.1.2 NITON XL300 XRF and spare battery in original case.

6.1.3 Barcode reader and laminated barcode sheet.

6.1.4 National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM) standards for verifying calibration.

6.1.5 **Documentation** (items 1-4, found in zip-lock bag under the upper case insulation).

6.1.5.1 Factory calibration sheet.

6.1.5.2 Valid instrument wipe test report.

6.1.5.3 Emergency Notification Sheet.

6.1.5.4 Performance Characteristic Sheet.

6.1.5.5 XRF Data Reporting Sheets.

6.1.5.6 Bulk Paint Sampling Form and Chain of custody form.

6.1.6 **Bulk Sampling Equipment**

6.1.6.1 Heat Gun Not to exceed 1100 degrees Fahrenheit.

6.1.6.2 Paint Scraper.

6.1.6.3 Utility Knife.

6.1.6.4 Masking Tape and Ruler.

6.1.6.5 Re-sealable plastic containers with labels and marker.

6.1.7 Meter usage

6.1.7.1 **Turning On and Calibration:** Calibration verification is to be done in the IH office prior to removal to the field, at the beginning and end of each new test area, after no more than 2 hours of use (in one area) and at the end of usage when returned to the IH office. Calibration checks should be done every time the instrument is turned on and prior to turning it off including work breaks.

6.1.7.1.1 Prepare the XRF Data Sheet completing the information in Section 1.

6.1.7.1.2 Review the calibration and wipe test certificates to ensure they are current.

6.1.7.1.3 Move the on/off switch pass setup to the on position. When the instrument is ready, check the date and time to

ensure accurate readings. If necessary reset to current time, date and action level before proceeding. From the main menu, select setup/specs then set time/date. Move through the time/date information with the clear/enter key changing information with the arrow up & down keys. When completed return to the main menu with the clear/enter key.

6.1.7.1.4 Check the Action level (1.0 mg/cm^2). If not correct or another is necessary, select Test Mode, Paint Mode then Setup Paint Protocol. Move through the choices with the Clear/Enter key and change items with the up and down arrow keys. Return to the Main menu.

6.1.7.1.5 If the mode is set to K&L Paint Spectra then select calibrate & test. Otherwise, select the Select Test Mode, Paint mode and then K&L Readings + Spectra Mode. The instrument will then return to the Main Menu screen.

6.1.7.1.6 Select Calibrate and Test. After 1-2 minutes the instrument will display Ready to Test.

6.1.7.1.7 Select a location for testing the calibration standard which allows the unit to remain flat and ensures that the user and any other room occupant is not in direct line with the direction of irradiation as shown on the front of the unit.

6.1.7.1.8 Place the test standard sheet on a smooth surface with the colored side up. Using the RED 1.08 +/- 0.09 test standard, move the shutter release lock forward and press the shutter release in and hold. Place the NITON flush on the surface with the window completely on the painted surface. The unit will lower onto the surface and the plunger will move up above the top of the unit. Let go of the shutter release, however, continue to hold the NITON to the test surface without lifting or moving the instrument.

6.1.7.1.9 While measuring, the unit will indicate the sample number and the word null until it has completed the test. It will also indicate the K & L test readings during the test. When completed, it will indicate the test result is either positive or negative, the lead concentration and the error range. Record the test number, reading and error range in the data sheet calibration section.

6.1.7.1.10 The reading should be 0.9-1.2 mg/cm^2 and indicate surface lead (a depth index at the upper right of the screen with readings: <= 1.5 very near surface; 1.5-4.0 moderately deep; >4.0 deeply buried lead). Repeat the test two more times. Report the individual and the average readings on the data sheet.

6.1.7.1.11 If the readings are high, check the surface under the test standard for lead concentration and repeat.

6.1.7.1.12 There are three reading views. First shows positive/negative and lead content. Second shows the same plus the spectra and the third shows all of this information plus the individual L & K shell readings and the depth index. You can toggle through the views using the clear/enter key, however, this is not necessary.

6.1.7.2 **Taking Readings**

6.1.7.2.1 Verify calibration at intervals described below.

6.1.7.2.2 Flick the barcode reader across one of the bar codes to display the Data Entry screen.

6.1.7.2.3 Enter the test location and other test information with the barcode reader.

6.1.7.2.4 Select a location for testing which allows the unit to remain flat and ensures that the user and any other room occupant is not in direct line with the direction of irradiation as shown on the front of the unit.

6.1.7.2.5 **Place the NITON flush on the surface with the window completely on the painted surface**, squeeze and release the shutter release and continue to hold the NITON to the test surface. The unit will lower onto the surface and the plunger will move up above the top of the unit. Do not move the instrument during the test period.

6.1.7.2.6 When the test is complete the unit will beep and the reading will switch from null to either positive or negative. Remove the NITON from the test surface and let go of the shutter release to close the shutter. The plunger should automatically return to the down position. Ensure that the plunger moves down completely allowing the shutter release safety slide to move under the shutter release.

6.1.7.2.7 Record the reading on the XRF Data Sheet.You are now ready for the next reading and will again input the sample information with the bar code reader. When a Data sheet is filled, begin another sheet by completing Section 1 and including the number of pages.

6.1.7.2.8 When sampling is completed, turn the instrument off (by sliding power switch to "off", lock the window, store in the original case and return the meter and documentation to the IH lab.

6.1.7.2.9 If you terminate a test before a "positive" or "negative" determination is attained by the instrument, it will display a "null" test result and it should be recorded but ignored.

6.1.7.3 **Recordkeeping:** The user may maintain a copy of the Niton software at a remote location and the data downloaded for the sample numbers created by the user. However, no data is to be deleted prior to returning the instrument to the IH lab. Only the IH Group Leader, Program Administrator or the lab technician shall delete data and then only after verification that the data has been retrieved and saved.

6.1.7.3.1 All paper work will be checked by the lab technician or designated Industrial Hygienist upon return of the instrument. In addition, he/she will perform a physical check of the instrument, case and accessories.

6.1.7.3.2 The stored data will be downloaded for comparison to the recorded field form and a copy will be provided to the user for their records and plant engineering for building Key Plan updates.

7.0 References

7.1 NITON Corporation, "300 Series & 700 Series User's Guide, version 5.2", 1998.

7.2 U.S. Department of Housing and Urban Development, "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, Ch. 7, Lead-Based Paint Inspection", 1997.

7.3 U.S. Environmental Protection Agency, "Method 6200 and Field Portable X-ray Fluorescence", 1998.

7.4 National Institute for Occupational Safety and Health (NIOSH), "Method 7702, Lead by Field Portable XRF", Jan. 1998.

7.5 BNL SBMS Lead Subject Area.

8.0 Attachments

8.1 **Theory of Sampling**
8.2 **Photograph of Meter**
8.3 **Short Operating Instructions**
8.4 **Niton LBP X-ray Fluorescence Meter Form**

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH10390**
	REVISION **SHSD FINAL Rev.0 RCD Review Draft**
SUBJECT: INSTRUMENT OPERATION: **Lead in Coatings by the** **NITON XL300 X-Ray Fluorescence Meter**	DATE **03-09-01** PAGE **11** OF 14

9.0 Documentation

Document Review Tracking Sheet		
PREPARED BY: *(Signature and date on file)* **J. Peters** **SHSD IH Group** **Date 02/07/01**	**REVIEWED BY:** *(Signature and date on file)* **R. Selvey** **SHSD IH Group Leader** **Date 02/26/01**	**APPROVED BY:** *(Signature and date on file)* **R. Selvey** **SHSD IH Group Leader** **Date 02/27/01**
Filing Code: **IH51SR.01**	**DQAR** **Date**	**Effective Date:** **02/28/01**

Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
03/09/01	*(Signature and date on file)* R. Selvey	Added "Leak Test Date:" to sample form, revised SOP number from IH-FP-161 to new system IH10390

Attachment 8.1
Theory of Operation

Each unit has specific criteria, which require different practices depending on its Performance Characteristic Sheet (PCS). Review the PCS prior to usage for determining inconclusive ranges for particular substrates.

Test results are determined for site, specific testing combinations. A testing combination is a unique combination of the room equivalent, building component type and substrate. Building components that are adjacent and not likely to have different paint histories, may be considered a single testing combination (e.g., window casings, stops, jambs and aprons; or door jambs, stops, transoms, casings and other door frame parts are single testing combinations).

XRF testing is required for at least one location per testing combination, except for interior and exterior walls, where four readings should be taken, one on each wall. Classify each wall based on its individual XRF reading.

The selection of the test location for a specific testing combination should be representative of the paint over the areas, which are most likely to be coated with old paint or other lead-based coatings. **Do not select locations where paint has worn away or been scraped off.** Area over pipes, electrical surfaces, nails and other possible interferences should be avoided.

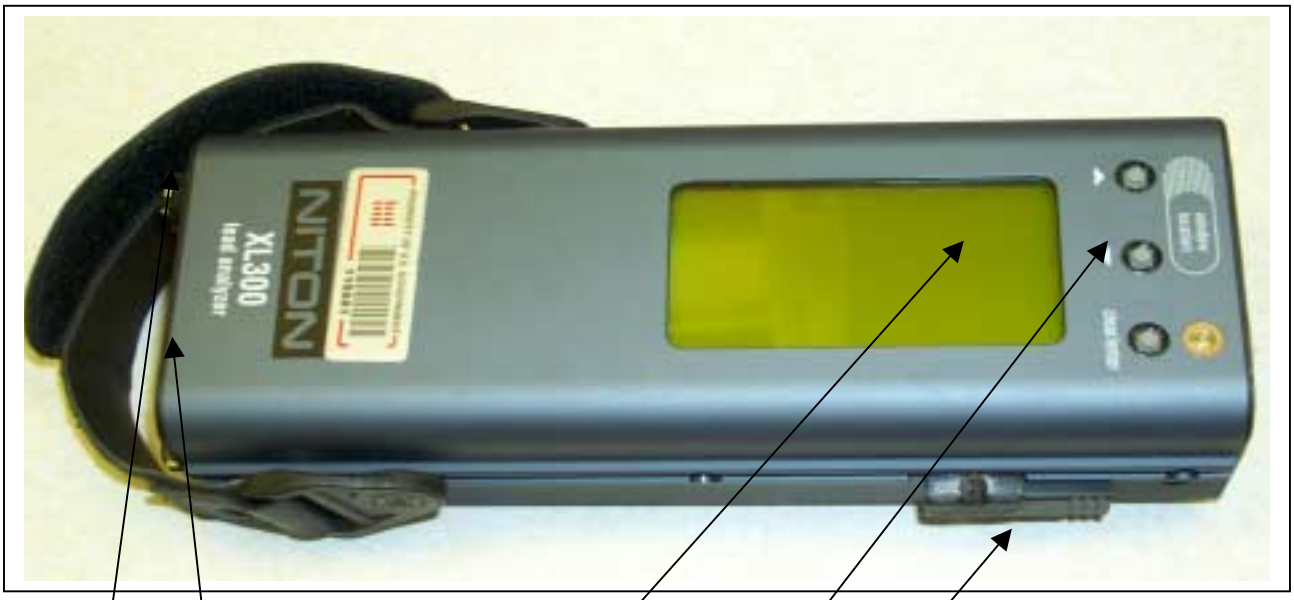
If no acceptable location for XRF testing exists for a given testing combination, a paint chip sample should be collected. The sample should include all paint layers with no substrate and should be taken as unobtrusively as possible.

XRF results are classified as positive, negative or inconclusive. A positive result indicates lead concentrations at or above the action level (1.0 mg/cm^2). The inconclusive range is provided on the PCS for different substrates. A reading falling within this range will be shown as inconclusive. A negative result indicates the lead concentration is below the inconclusive range. The threshold listed on a PCS indicates that the upper and lower bounds of the inconclusive range are equal. A positive reading is above the threshold and a negative reading is below the threshold.

The instrument can test curved surfaces (down to about a ½ inch radius) even though the window is not flat on the surface. For surfaces, which cannot be tested, a bulk sample shall be collected for laboratory analysis.

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH10390**
	REVISION **SHSD FINAL Rev.0** **RCD Review Draft**
SUBJECT: INSTRUMENT OPERATION: **Lead in Coatings by the** **NITON XL300 X-Ray Fluorescence Meter**	DATE **03-09-01**
	PAGE **13** OF 14

Attachment 8.2
Photograph of Meter



Serial Port

On-Off Switch

Battery

(Top)

LCD Display

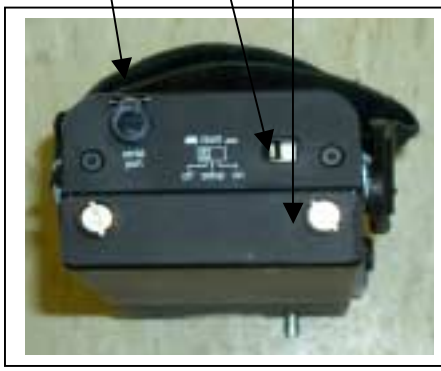
Enter / Scroll Keys

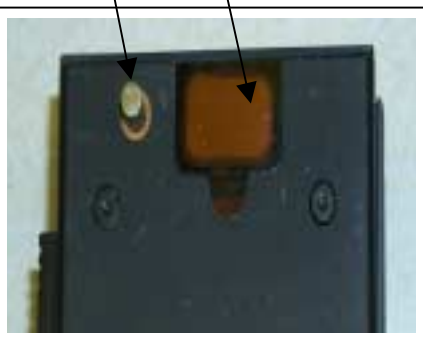
Trigger

(Bottom)

Shutter Release

X-Ray Window





BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH10390**
	REVISION **SHSD FINAL Rev.0** **RCD Review Draft**
SUBJECT: INSTRUMENT OPERATION: **Lead in Coatings by the** **NITON XL300 X-Ray Fluorescence Meter**	DATE **03-09-01**
	PAGE **14** OF 14

Attachment 8.3

Short Operating Instructions

	Step	User Action	Display
1	**Turning On**	Move the on/off switch pass setup to the ***ON*** position	*"Niton XL system start..."* flashes for 2 seconds, then "*Calibrate & test* *Select Mode ->* *Setup/specs. ->* *Download/Erase Data ->"* *Mode: Std. Paint* *Date Time"*
2	**Pre-Calibration**	Select "Calibrate and Test" by pressing **[clear/enter]**	*"Start Paint Mode"* flashes for 2 seconds, then a scan appears for 1 minute. *"Starting: Please Wait nn% Complete"* After 1-2 minutes the instrument will display *"- - > Ready to Test <- - ".*
		Measure the "standard sheet". Move the shutter release lock forward and press the shutter release in and hold.	*"Reading #nnn"*. When completed, it will indicate the test result is either positive or negative, the lead concentration and the error range
3	**Taking Readings**	Attach the barcode reader and scan one of the bar codes to display the Data Entry screen. Enter the test location and other test information with the barcode reader.	Information on the sample location will display on the screen
		Place the NITON flush on the surface, squeeze and release the shutter release and continue to hold the NITON to the test surface.	*"Reading #nnn"*. When the test is complete the unit will beep and the reading will switch from null to either positive or negative
4	**Post-Calibration**	Repeat step 2 above.	
5	**Turning Off**	Move the on/off switch pass setup to the ***OFF*** position & lock the shutter release.	Display goes blank

BROOKHAVEN NATIONAL LABORATORY SAFETY & HEALTH SERVICES DIVISION		**DIRECT READING INSTRUMENT** **NITON LBP X-Ray Fluorescence Meter (XRF)**
DATE:	SURVEYOR(S):	Sheet ____ of ____

I. AREA INFORMATION		
DEPT:	BLDG:	ROOM:
Work Control Project #:		
Supervisor:		

II. EMPLOYEE INFORMATION

This section is not typically applicable. Use comment section for recording employee exposure information if available.

III. SURVEY INSTRUMENT INFORMATION		
INSTRUMENT: **NITON XRF**	MODEL**: XL-300 (Blue Colored Case)**	SERIAL#: **U2070NR1051** BNL#: **115661**
FACTORY CALIBRATION DATE:	SOURCE: Cd 109 10 mCi	DATE SOURCE INSTALLED: LEAK TEST DUE:

IV. SAMPLING INFORMATION & RESULTS

Pre-sampling Calibration Data Date:_____		**Post-sampling Calibration Data Date:_____**	
Sample #	LBP Result	Sample #	LBP Result

Calibration Data Within Appropriate Range (0.9 – 1.2 mg/cm^2) ? _____YES ____NO
If NO, do not use meter and return to IH lab.

Sample #	**Room Equivalent**	**Component**	**Substrate**	**Color**	**Quantity (SF)**	**Condition**	**LBP Result (mg/cm^2 +/-)**	**Positive/ Negative**

Continued on reverse side ? ____Yes / ____No

Substrate = Brick, Block, Concrete, Drywall, Metal, Plaster, Wood
mg/cm^2 = milligrams per square centimeter
Condition = poor, fair, intact
SF = square feet

Comments:

Return completed form with instrument to: IH Lab

BROOKHAVEN NATIONAL LABORATORY SAFETY & HEALTH SERVICES DIVISION	**DIRECT READING INSTRUMENT** **NITON LBP X-Ray Fluorescence Meter (XRF)**
DATE:	SURVEYOR(S):

Sample #	Room Equivalent	Component	Substrate	Color	Quantity (SF)	Condition	LBP Result (mg/cm^2 +/-)	Positive/ Negative

Remember to verify calibration on closeout (see front page)

Sample Location Drawing (optional)